

# Portable Micro Gas Chromatography – Fast and Accurate Analysis of Biogas and Related Streams

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## Introduction

This poster shows the analysis of biogas and related streams in about 2 minutes using the Micro GC based Biogas Analyzer (Figure 1). The Micro GC can be equipped with one to four independent column channels. Each column channel is a complete, miniaturized GC with electronic carrier gas control, micro-machined injector, narrow-bore analytical column and micro thermal conductivity detector ( $\mu$ TCD).

## Micro GC Biogas Analyzers

Results in seconds instead of minutes - when speed matters

Rugged, compact, laboratory-quality analysis platform

Pre-configured, factory-tested and ready to perform your analysis

Spend less time on method setup, and more time on generating results

When and where you need it - on the lab, in the field or in a process environment



Figure 1. Micro GC based Biogas Analyzers.

## What is biogas?

- A gas mixture produced through biological processes; from anaerobic fermentation or digestion of organic material such as biomass, manure or sewage, municipal waste and energy crops.
- Its composition is related to the origin of the organic material; the main components of biogas are a mixture of methane and carbon dioxide, with some other permanent gases, hydrogen and hydrogen sulfide.
- To increase its calorific value the biogas could be mixed with other hydrocarbon stream, like natural gas and liquefied petroleum gas.
- Biogas is considered a renewable fuel source; the increased interest in biogas around the world has resulted in a growing demand for fast, accurate and efficient analysis technology to determine its composition.<sup>[1]</sup>

## Instrument Setup

For the analysis of pure biogas the Agilent 490 Micro GC Biogas Analyzer (part number G3582A#110) is used.<sup>[2]</sup>

This Micro Gas Chromatograph includes two independent controlled column channel equipped with a:

- Molecular sieve column (CP-MolSieve 5Å)
- Porous polymer column (PoraPLOT U)

When biogas is mixed with other hydrocarbon streams such as natural gas or liquefied petroleum gas (LPG), the sample contains higher boiling hydrocarbons.

To analyze this sample type, the Agilent 490 Micro GC Biogas Analyzer Extended (part number G3582A#111) is used. This extended analyzer includes three column channel; the first two identical to the Biogas Analyzer, the third channel equipped with a:

- Dimethylpolysiloxane column (CP-Sil 5 CB)

## Fast Analysis of Biogas

### Permanent gases on the molecular sieve column

The first column channel, equipped with a molecular sieve column, is used to analyze the permanent gases, including hydrogen, oxygen, nitrogen, methane and carbon monoxide. A chromatogram for this column channel is shown in Figure 2.

### Porous polymer column for CO<sub>2</sub> and H<sub>2</sub>S analysis

For pure biogas; carbon dioxide and hydrogen sulfide are analyzed on a second GC channel equipped with a porous polymer column. Baseline separation for carbon dioxide and hydrogen sulfide is obtained on this channel, shown in Figure 3.

### Inert sample path for hydrogen sulfide analysis

The stainless steel surfaces in the porous polymer column channel and the sample inlet of the Micro GC have an UltiMetal deactivation layer, which results in an inert sample flow path and excellent peak shape for hydrogen sulfide (Figure 3), even at low concentrations.

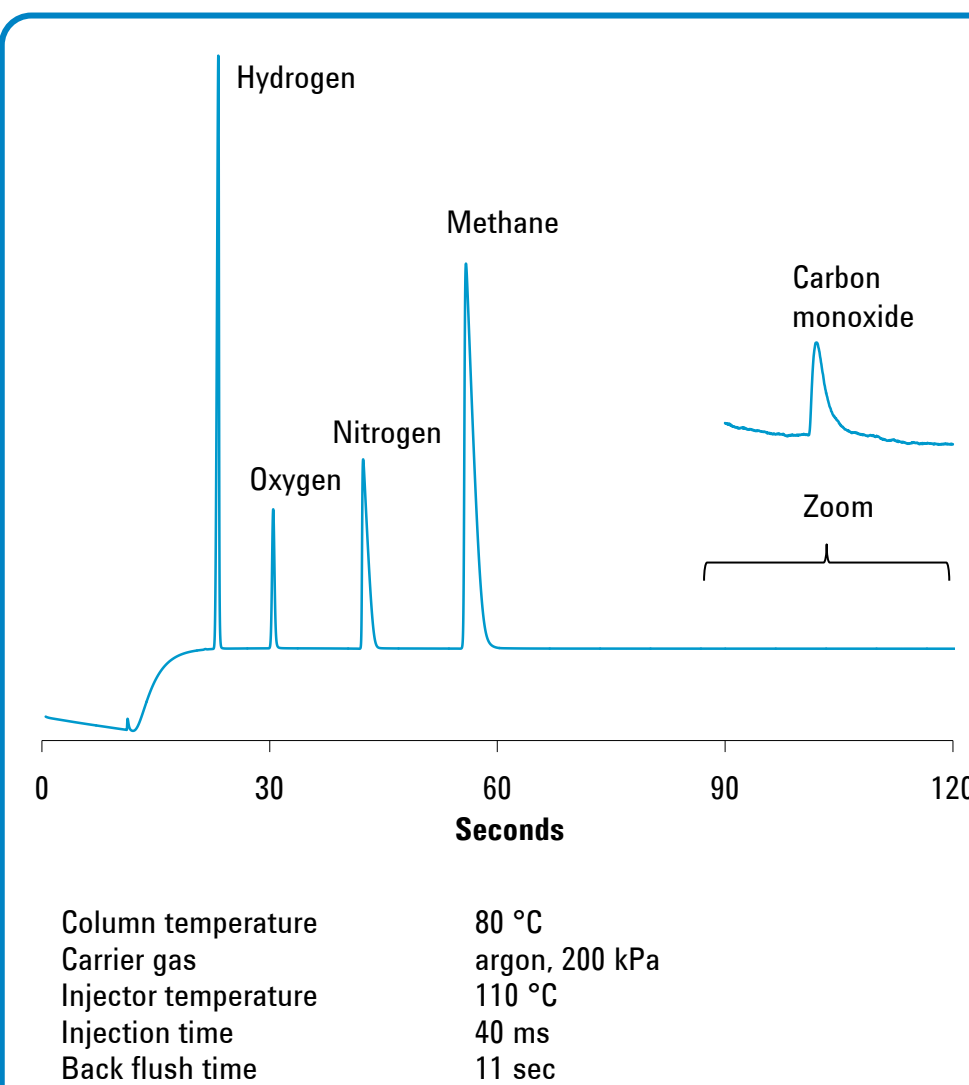


Figure 2. Chromatogram for biogas on the molecular sieve column.

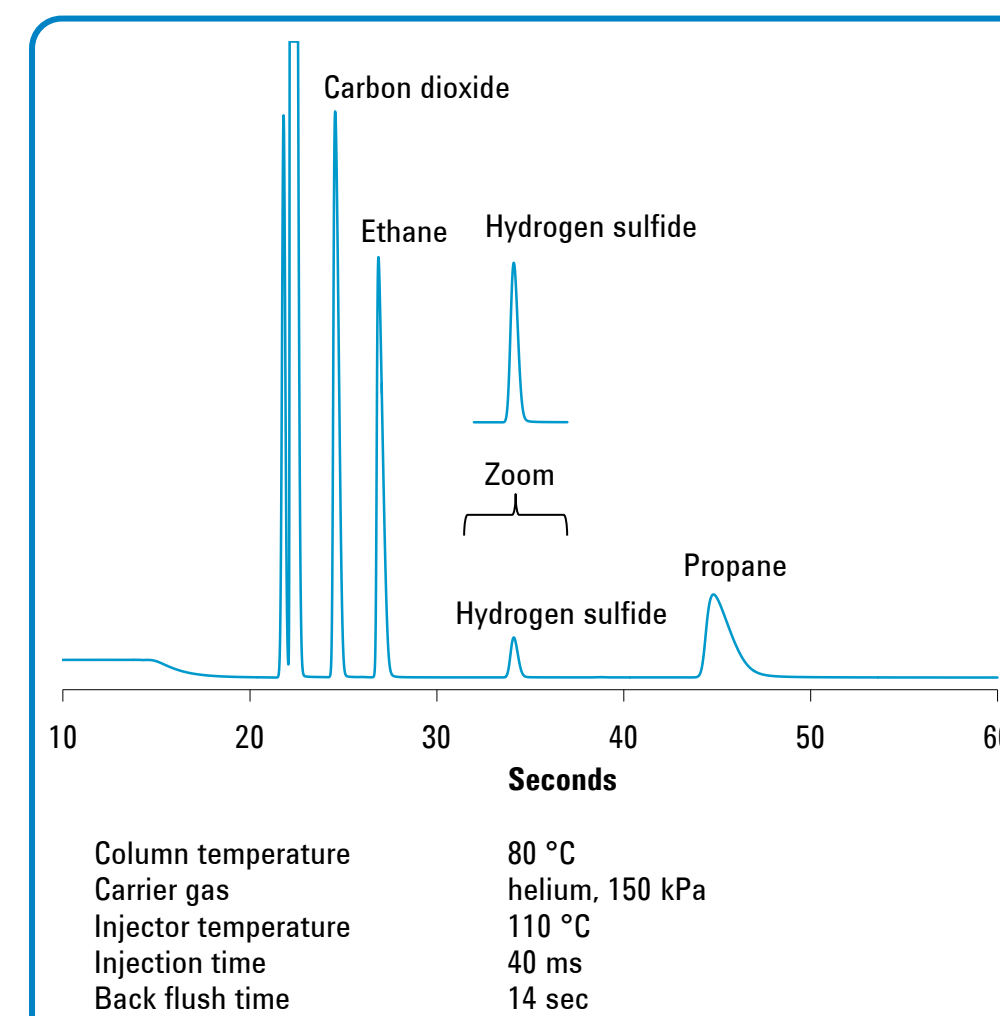


Figure 3. Chromatogram for biogas sample on a porous polymer column.

### Mobile analysis provided by portable field case

The portable field case (Figure 4) is designed for true mobility; integrated rechargeable batteries and up to two different carrier gas canisters provide out-of-lab measurements.



Figure 4. With a portable field case, gas analysis in the field is made easy.

## Extended Analysis for Biogas Blends

Blending biogas with other hydrocarbon stream, like natural gas and liquefied petroleum gas, is one of the possibilities to increase its calorific value. To extend the application range of the biogas analyzer to these blended streams, an additional channel with dimethylpolysiloxane column is required.

### Hydrocarbons on a dimethylpolysiloxane column

Ethane and propane were separated on the porous polymer channel (Figure 3). Higher hydrocarbons present in the sample, are back flushed to vent. This prevents late eluting components from interfering in the next analysis. In addition, this results in shorter analysis time.

The sample injected on the dimethylpolysiloxane column separates the hydrocarbons from the butanes until n-heptane. A chromatogram of biogas, blended with natural gas, is displayed in Figure 5.

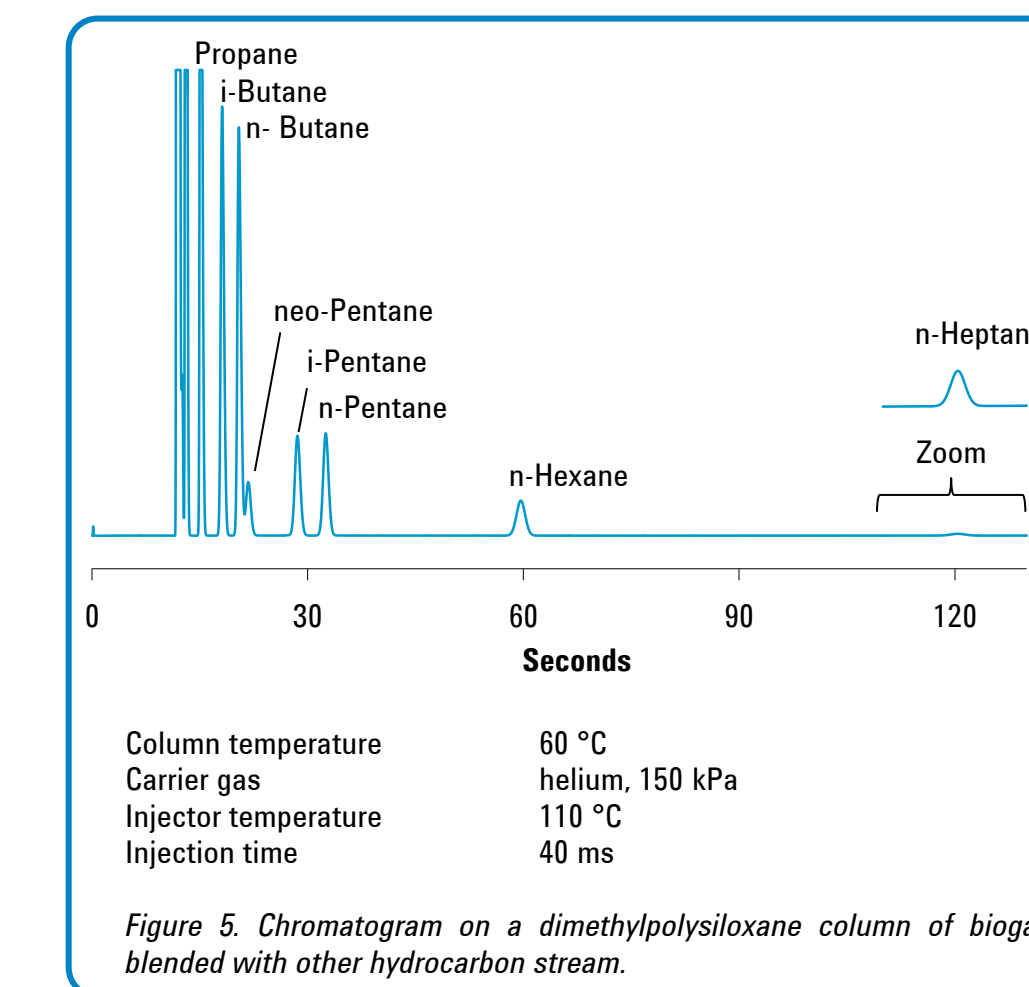


Figure 5. Chromatogram on a dimethylpolysiloxane column of biogas blended with other hydrocarbon stream.

## Conclusions

- Micro GC based analyzer can be used for fast and accurate analysis of biogas and related streams; baseline separation for all compounds of interest is obtained.
- The portable field case provides on-the-go measurements using build-in carrier gas cylinders and rechargeable batteries.
- Regular biogas, containing methane, carbon dioxide, nitrogen, and some hydrogen, hydrogen sulfide and carbon monoxide, can be analyzed with Micro GC equipped with a molecular sieve and porous polymer column channel.
- When biogas is blended with other hydrocarbon streams, such as natural gas or LPG, and additional dimethylpolysiloxane column is required for the analysis of hydrocarbons from butane.
- The back flush functionality ensures that the undesired compounds will not enter the analytical column, which results in the protection of the column and shorter analysis times.
- Deactivation of the stainless steel surfaces in the sample inlet of the Micro GC (UltiMetal treatment) results in excellent peak shape for hydrogen sulfide.

## References

To learn more about the Agilent 490 Micro GC Biogas Analyzer visit [www.agilent.com/chem/microgc](http://www.agilent.com/chem/microgc)

- 5990-9508EN; Application Note - Analysis of Biogas Using the Agilent Biogas Analyzer; November 2011.
- 5990-9517EN; Data Sheet - Agilent 490 Micro GC Biogas Analyzers; November 2011.
- 5991-1093EN; Brochure - Agilent Analyzers and Application Kits; October 2012.

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